SURVEY OF WEAPONS DEVELOPMENT AND TECHNOLOGY

WR708

SESSION XV

• ARMS CONTROL ISSUES
The Evolution of Response Time

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1948</td>
<td>Berlin blockade</td>
<td>2 days to assemble</td>
</tr>
<tr>
<td>1957</td>
<td>Suez</td>
<td>few hours to launch</td>
</tr>
<tr>
<td>1959</td>
<td>DEFCON established</td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>JSTPS &amp; SIOP</td>
<td>1/3 of bombers ready for immediate take-off</td>
</tr>
<tr>
<td>1962</td>
<td>Cuban missile crisis</td>
<td>1/8 on airborne alert</td>
</tr>
</tbody>
</table>
Arms Control Treaties

- Geneva Protocol 6/25
- NATO established 8/49
- US Troops to Europe
- Antarctic Treaty 12/59
- Test Moratorium 3/58-8/61
- Hot Line Agmt 6/63
- Limited Test Ban 8/63

- Stalin
- Truman
- Eisenhower
- Kennedy
- Johnson
- Khrushchev
- Brezhnev

- 45
- 50
- 55
- 60
- 65

- Berlin
- Korea
- Suez
- Cuba

- Outer Space Treaty 1/67
- Latin America N/PZ 2/67
- Seabed Arms Control 9/71
- Non-Proliferation Treaty 7/68
- Biological Weapons Convention 4/72
- Accident Measures 9/71
- Threshold Test Ban 1/74
- PNE Treaty 5/72
- SALT I 6/79
- SALT II 6/79

- 70
- 75
- 80
- 85
- 90

- Nixon
- Ford
- Carter
- Reagan
- Bush

- Yom Kippur
- Afghanistan
- Chernobyl

- Brezhnev
- Andropov
- Chernenko
- Gorbachev
- Yeltsin

INF 12/87
CFE 11/90
START 7/91
Pres Neu Initiative 9/91
Lisbon Protocol 5/92
START II 1/93
Reykjavik Summit 10/86
CBL 6/10/94
The Geneva Protocol - 1925

Banned the use in war of asphyxiating, poisonous, or other gases and of bacteriological methods of warfare

US ratified in 1975

All major states now parties

UN Conference on Disarmament is working toward a ban on production and stockpiling
Test Moratorium - 1958 to 1961

In March 1958, Soviets declared moratorium

In October, negotiations on CTBT began & Eisenhower announced 1-yr U. S. moratorium

May 1960 U-2 incident scrubbed planned summit

Kennedy Administration resumed talks

August 1961, citing French test, Soviets resumed testing

Soviets conducted over 50 tests in the last 3 months of 1961
The Limited Test Ban Treaty - 1963

Limited nuclear tests to underground

Original signatories were US, Soviet Union, and UK

US ratified 10/63

More than 100 parties now

France ceased above ground tests in 1974, China in 1980
The Nonproliferation Treaty - 1968

- Eisenhower proposed "Atoms for Peace" in 1953
- IAEA established in 1957 to promote and monitor
- Nuclear Nonproliferation Treaty was negotiated from 1965 and signed in 1968
- NPT Review Conferences every 5 years
- After 25 years (April 1995) the Review and Extension Conference (Chaired by Amb. Dhanapala) decided on indefinite extension - without a vote
- In exchange for peaceful use of atomic energy, signatories agree to safeguards
States not party to the NPT (as of 1/23/97)

- Brazil
- Cuba
- India
- Israel
- Macedonia
- Pakistan
- Serbia/Montenegro
Biological and Toxin Weapons Convention

Outlaws development, production, stockpiling of all biological or toxin weapons and requires destruction of existing stocks

No specific verification provisions

Signed in 1972 and ratified by the US in 1975

Nixon ended US program in 1969 and destroyed stocks

Soviet incident at Sverdlovsk in 1979
SALT I - 1972

Interim Agreement on Strategic Offensive Arms

Limited launchers (silos and sub tubes) to the then current number
  US - 1710       SU - 2347

Limit on heavy launchers (SS-9 and later SS-18)

Five year duration

US ratified in Oct 1972

Reagan repudiated SALT I and II in May 1986

- Preserve the ABM Treaty, prevent circumvention, and enhance viability
- TBM systems may be deployed, but must not threaten strategic nuclear forces
- TBM systems will not be deployed against each other (?)
- SCC to complete demarcation between TBM and ABM
  - target missile velocity < 5 km/s, range < 3500 km
  - no space based TBM interceptors based on OPP
ABM Treaty - 1972

Johnson and McNamara tried to convince Kosygin at Glassboro to limit ABM systems - June 1967

US announced Sentinel program in September 1967

ABM talks were postponed by Soviet invasion of Czechoslovakia in 1968

Nixon changed concept to Safeguard, protecting ICBMs and Washington, DC

Treaty prevents defense of territory, limits to 2 sites with 100 interceptors, limits LPARS

Forbids mobile ABMS or sea, air, or space systems

OPP, Krasnoyarsk, SCC, capabilities questions
Threshold Test Ban Treaty - 1974

Signatories are the US, Soviet Union, and UK

Limits nuclear tests to 150kT

Verification by NTM (seismic)

A two page treaty

Joint Verification Experiment in 1988

US ratified in 1989
Peaceful Nuclear Explosives Treaty - 1976

Limited peaceful nuclear explosives to 150kT

Permitted maximum aggregate yield of 1.5 MT, with on site monitoring for yields above 150kT

Plugged a loophole in the TTBT
SALT II - 1979

<table>
<thead>
<tr>
<th>Limited and reduced SNDVs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All SNDVs</td>
<td>2250</td>
</tr>
<tr>
<td>MIRVed ICSs, SLs, bombers</td>
<td>1320</td>
</tr>
<tr>
<td>MIRVed ICs, SLs</td>
<td>1200</td>
</tr>
<tr>
<td>MIRVed ICs</td>
<td>820</td>
</tr>
</tbody>
</table>

One new type, no new heavies, MIRV limits

CM counting rules, FRODs, Backfire statement

Verification by NTM, no encryption

12/79 Afghanistan, withdrawn from ratification

"Fatally flawed," no undercut, then terminated 5/86
Conventional Forces in Europe - 1990

MBFR talks ended after 15 years in February 1989

CFE talks formally opened March 1989, with the 23 members of NATO and the Warsaw Pact

Treaty signed November 1990

Treaty limits equipment in the Atlantic to the Urals (ATTU) region

Limits on tanks, artillery, ACVs, combat aircraft, attack helicopters

Wide-ranging and intrusive verification regime
START Treaty - 1991

Signed July 31, 1991, 5 months before the end of SU

Lisbon Protocol, signed May 1992, committed Russia, Ukraine, Belarus, and Kazakhstan to START (and NPT)

START limits SNDVs and deployed warheads:

<table>
<thead>
<tr>
<th>Category</th>
<th>START</th>
<th>US forces*</th>
<th>Soviet forces*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNDVs</td>
<td>1600</td>
<td>2246</td>
<td>2500</td>
</tr>
<tr>
<td>ICBM &amp; SLBM Warheads</td>
<td>4900</td>
<td>8210</td>
<td>9416</td>
</tr>
<tr>
<td>Total Warheads</td>
<td>6000</td>
<td>10563</td>
<td>10271</td>
</tr>
<tr>
<td>Heavy ICBM Warheads</td>
<td>1540</td>
<td>-----</td>
<td>3080</td>
</tr>
<tr>
<td>Mobile ICBM Warheads</td>
<td>1100</td>
<td>-----</td>
<td>618</td>
</tr>
<tr>
<td>Throw-wt ICs &amp; SLs</td>
<td>3600</td>
<td>2631</td>
<td>6626</td>
</tr>
</tbody>
</table>

(metric tons)

*as of 9/90
Nuclear Posture Review - 9/94

• Strategic Forces
  – No more than 20 B-2 bombers
  – Reduce B-52 force from 94 to 66
  – Reduce Trident fleet from 18 to 14
  – Maintain single RV MM III

• Non-Strategic Nuclear Forces
  – Maintain European NSNF at current level
    (<10% of Cold War levels)
  – Eliminate nuclear weapons capability from surface Navy
  – Retain cruise missile capability on subs
  – Retain land-based DCA
Comprehensive Test Ban Treaty - 200?

- Adopted by the UNGA 9/10/96
  - CD could not reach consensus (India)
- EIF requires 44 states with reactors
  - includes India, Iran, Egypt, Israel, North Korea, Pakistan
- Activities not prohibited - finessed
  - US "true zero" yield
- Zero not verifiable, less than 1kT too expensive
- International Monitoring System
  - Seismic, Radionuclide, Hydroacoustic, Infrasound
  - OSI requires 30 of 51 Executive Council votes
START III - 200?

- Clinton and Yeltsin at Helsinki Summit, March 21, 1997
  - Immediate START III negotiations upon START II EIF
  - 2,000 - 2,500 strategic warheads by end of 2007
  - Transparency of strategic warhead inventories
  - Measures to promote irreversibility of warhead reductions
  - Deactivation of SNDVs under START II by end of 2003
  - Elimination deadline for SNDVs extended to end of 2007

*Joint Statement on Parameters on Future Reductions in Nuclear Forces*
The President's Nuclear Initiative-1991

Sept 1991
- Eliminate ground launched tactical nuclear weapons
  - Lance and AFAPs
- Withdraw tactical nuclear weapons from surface ships, subs and P-3 bases
  - B-57, SLCM, B-61
- Stand down strategic bombers from alert
- Stand down MX
- Cancel mobility for PK and SICBM
- Cancel SRAM II
- Propose joint elimination of MIRVed ICBMs

Jan 1992
- Build only 20 B-2s
- Cancel SICBM
- Halt production of ACM
- Halt production of W88 for Trident II
START II - 1993


START II builds on START - and requires START

<table>
<thead>
<tr>
<th></th>
<th>START</th>
<th>START II Ph1</th>
<th>START II Ph Ph2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Warheads</td>
<td>6000</td>
<td>3800-4250</td>
<td>3000-3500</td>
</tr>
<tr>
<td>ICBM &amp; SLBM Warheads</td>
<td>4900</td>
<td>no sublimit</td>
<td>no sublimit</td>
</tr>
<tr>
<td>MIRVed ICBM Warheads</td>
<td>N/A</td>
<td>1200</td>
<td>0</td>
</tr>
<tr>
<td>SLBM Warheads</td>
<td>N/A</td>
<td>2160</td>
<td>1700-1750</td>
</tr>
<tr>
<td>Heavy ICBM Warheads</td>
<td>1540</td>
<td>650</td>
<td>0</td>
</tr>
<tr>
<td>Mobile ICBM Warheads</td>
<td>1100</td>
<td>1100</td>
<td>1100</td>
</tr>
</tbody>
</table>

Phase one to be complete 7 years after entry-into-force,
Phase two by 2003
Comprehensive Test Ban

- Negotiations ongoing at the UN CD
- China testing through '96
- France resumed (8 tests) 9/95 - 5/96
- Activities not prohibited
  - US - "true zero"  UK - soon, US codes
  - France - OK  Russia - eventually
  - China - waffling, still wants PNEs
- Zero not verifiable, less than 1kT too expensive
- International Monitoring System
  - Seismic - 50 stations, 50 - 150 auxiliaries
  - Radionuclide - Ba140, 75 - 100 stations, US wants Xe
  - Hydroacoustic
  - Infrasound - 50 - 60 stations
- Implementing agency - IAEA or ?
Books of interest

   Pulitzer prize winner, follows the scientific discoveries that led to the bomb, particularly good at the personalities involved, finishes with vivid descriptions of Hiroshima and Nagasaki. Excellent and entertaining.

At the Highest Levels, Michael R. Beschloss and Strobe Talbott, 1993.
   Intimate details of the end of the Cold War, as seen at the top.

   Details the end of the Soviet Union from the viewpoint of the Russian people and their legacy. Choppy, but a very human picture of the great event.

The Wizards of Armageddon, Fred Kaplan, 1983.
   Follows the policy and strategy decision regarding nuclear weapons, much emphasis on the early RAND personalities. Very good and readable.
Nonproliferation
A New Challenge to the US Nuclear Weapon Program

SESSIONS XVI
John Taylor
National Security Policy Research Department
Sandia National Laboratories
Some Definitions

Proliferation is the spread of weapons of mass destruction (WMD)--typically nuclear, biological, and chemical weapons--and the systems which deliver them.

Nonproliferation is the use of the full range of political, economic and military tools to prevent proliferation, reverse it diplomatically, or protect our interest against an opponent armed with WMD or missiles.

Counterproliferation measures are the activities of the DoD across the full range of U.S. efforts to combat proliferation.
### The Changing Context

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bipolar Rigidity</td>
<td>Multipolar Complexity</td>
</tr>
<tr>
<td>Predictable</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Communism</td>
<td>Nationalism/Religious Extremists</td>
</tr>
<tr>
<td>U.S. Dominant Western Power</td>
<td>U.S. Militarily No.1 - Not Economical</td>
</tr>
<tr>
<td>Fixed Alliances</td>
<td>Ad Hoc Coalitions</td>
</tr>
<tr>
<td>&quot;Good Guys and Bad Guys&quot;</td>
<td>&quot;Grey Guys&quot;</td>
</tr>
<tr>
<td>U.N. Paralyzed</td>
<td>U.N. Viable</td>
</tr>
</tbody>
</table>

### The Changing Threat

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single (Soviet)</td>
<td>Diverse</td>
</tr>
<tr>
<td>Survival at Stake</td>
<td>American Interests at Stake</td>
</tr>
<tr>
<td>Known</td>
<td>Unknown</td>
</tr>
<tr>
<td>Deterrable</td>
<td>Non-Deterrable</td>
</tr>
<tr>
<td>Strategic Use of Nukes</td>
<td>Terroristic Use of Nukes</td>
</tr>
<tr>
<td>Overt</td>
<td>Covert</td>
</tr>
<tr>
<td>Europe-Centered</td>
<td>Regional, Ill-Defined</td>
</tr>
<tr>
<td>High Risk of Escalation</td>
<td>Little Risk of Escalation</td>
</tr>
</tbody>
</table>

A Snapshot of the World

- 253 Sovereign nations, dependent areas, etc.
- 189 (+) Countries
- 177 Members in the United Nations
- (171 Members in FIFA!)

- 60 conflicts in progress involving more than 130 states or subnational entities
### All the World's Conflicts - May 1998

#### Area | Countries | Intensity | Nature of Conflict
--- | --- | --- | ---

#### Summary and Analysis

**Intensity by type and percent of total**
- **High**: 1 (100%) 1% (10%)
- **Medium**: 17 (30%) 28% (30%)
- **Low**: 12 (40%) 71% (70%)
- **Totals**: 60 (100%) 58%

Numbers in () from last reporting period (2/96).

---

**Number and Percentage by Conflict Type**

<table>
<thead>
<tr>
<th>Conflict Type</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territory</td>
<td>15</td>
<td>28%</td>
</tr>
<tr>
<td>Ethnic</td>
<td>31</td>
<td>53%</td>
</tr>
<tr>
<td>Oil</td>
<td>4</td>
<td>7%</td>
</tr>
<tr>
<td>Civil War</td>
<td>30</td>
<td>52%</td>
</tr>
<tr>
<td>Religious</td>
<td>9</td>
<td>16%</td>
</tr>
</tbody>
</table>

**Percent of Total by Region**
- Europe: 12%
- Latin America: 19%
- Africa: 31%
- Middle/Near East: 12%
- South Asia: 8%
- Southeast Asia: 7%
- Far East: 10%

---
Alva Myrdahl's Historical View of Nuclear Weapon Controls

CTBT

NPT  Cutoff
What Constitutes a Weapon of Mass Destruction

- Indiscriminate nature of use
- Effect not confined to belligerents
- Excessive injury -- "cruel and unusual"
- Inability to defend against effectively
- Use would overwhelm medical and evacuation resources
- Notion of "terror"
Motivation to Acquire Weapons of Mass Destruction

Great Powers have always countered the weapons of other great powers (e.g., USSR in the late 1940s)

Fear that a great power ally will not follow through (e.g., UK, France)

Fear over nuclear capabilities of potential adversaries (e.g., PRC, India, Pakistan, Iran, perhaps US in 1940s)

Fear of adversaries conventional strength (e.g., Israel, perhaps US in 1940s)

Cheaper than conventional defense (e.g., US in 1950s)

Desire for offensive capability (e.g., US in 1940s?)

Status in world or region (e.g., Iraq)
### Some Proliferants of Concern

<table>
<thead>
<tr>
<th>Country</th>
<th>☢️</th>
<th>💀</th>
<th>✪</th>
<th>🔘</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>☢️</td>
<td>💀</td>
<td>✪</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>☢️</td>
<td>💀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iran</td>
<td>☢️</td>
<td>💀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iraq</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Korea</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belarus, Kaz., Uk.</td>
<td>☢️</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- ☢️: Thought to possess capability
- ✪: May possess capability
- 💀: Thought not to possess capability
"Cost Effectiveness" of Weapons of Mass Destruction

The cost of producing, storing and delivering weapons can be estimated as the amount of money to deliver one lethal dose.

For nuclear weapons = $2000

For chemical weapons = $100

For biological weapons = $1
How many nuclear weapons states will there be in the year 2000?

Nuclear weapon proliferation has been surprisingly slow but uncomfortably steady*

*Data from news and journal articles in 1992
Nuclear Proliferation: A Current Status

- Acknowledged/Declared Nuclear Weapon States
  -- US, UK, China, France, Russia
- Undeclared but widely suspected Nuclear Weapon States
  -- India, Pakistan, Israel
- "Inheritors" of Soviet weapons
  -- Ukraine, Kazakhstan, Belarus
- Virtual Nuclear Weapon States (e.g., weapon capabilities but no weapons)
  -- Japan, Germany
- Threshold Nuclear Weapon States
  -- North Korea
- Aspiring Proliferators
  -- Iraq, Iran, Libya, Algeria, various terrorist organizations
- Rollback cases
  -- Argentina, Brazil, Sweden, Switzerland, Egypt, Taiwan, South Africa(?)
There have been some Nonproliferation Successes

- Sweden abandoned its programs in the 1970s.
- South Africa stopped its programs in 1992 (6 weapons).
- Argentina and Brazil renounced their programs.
- Taiwan and South Korea abandoned their programs in the 1980s.
- Iraq's program "put on hold" by Desert Storm and UN Resolution 687 and 715.
- Belarus, Kazakhstan, and Ukraine (?) have agreed to return the FSU weapons to Russia.
- NPT indefinitely extended by "pseudo consensus"
WMD Technological Capabilities

Nuclear:
5 acknowledged possessors, 30 countries with "capability"

Chemical:
20-24 possessors, 80-90 countries and some subnational entities with "capability"

Biological:
10-12 possessors, virtually every state and several subnational entities are "capable"

(Conventional weapons:
virtually every country possess, 10-40 are major suppliers)
Why Not Zero?

Many nations and individuals want us to completely eliminate weapons -- attractive philosophy but dubious policy:

likelihood of war

There may be things worse than nuclear weapons (e.g. biologics)